



# NUTRIENTS IN SAN FRANCISCO BAY REGION WASTEWATER

A harmful algae bloom event occurred in San Francisco Bay (SF Bay), beginning in late July 2022. Discolored waters in the Oakland estuary were an early indication of the presence of the algae species *Heterosigma akashiwo*. This species of algae may produce substances that are toxic to fish, but has not been shown to be harmful to humans. The algae bloom subsequently spread between the Bay Bridge and the Dumbarton Bridge, and extended into other regions of the Bay.

The bloom peaked in late August and began to die off by August 31, which caused substantial decreases in the amount of dissolved oxygen in the water. As oxygen levels declined, a significant fish die-off was observed in multiple locations around the Bay.

Since algae need nutrients to grow, regulators, wastewater agencies, and scientists are continuing to examine how nutrients are managed in the SF Bay region. **Below are answers to frequently asked questions about nutrients in the SF Bay.**

## What are “nutrients” and why are they in wastewater?

Nutrients, along with light exposure, are essential to the process of photosynthesis which is how plants like algae grow. In the San Francisco Bay ecosystem, nitrogen is the primary nutrient of concern since decreasing nitrogen can limit algal growth. Nitrogen in wastewater mostly comes from human urine.

## What role did nutrients play in the 2022 algal bloom?

We don't know what started the algal bloom, but once it began, the algae were able to use nutrients in the SF Bay to grow and extend throughout much of the region. In recent years, wastewater treatment plants have decreased the amount of nitrogen they add to the SF Bay, so we know that the bloom was not triggered by an increase in nitrogen in 2022.

## What role do nutrients play in nature?

Nutrients are necessary for healthy ecosystems to produce algae, which are necessary to support life in all water bodies. However, under certain conditions, over-enrichment of nutrients can lead to too much algal growth. As the algae die off and decompose, oxygen in the water is depleted, causing harm to fish and wildlife. In addition, some algal species can produce toxins that directly harm aquatic life.

## What fraction of nutrient loads to the Bay are from wastewater treatment plants?

Approximately 2/3 of the nutrients that are added to the SF Bay come from the 37 wastewater treatment plants in our region that discharge to SF Bay. The remaining 1/3 comes from the Sacramento River Delta and stormwater runoff.

## What role did climate change play in the 2022 SF Bay algal bloom?

Algae are plants, and need light to grow.

During Summer 2022, there were two unusual conditions in the SF Bay – less fog and clearer water than usual.

These two factors are linked to climate change and increased the amount of sunlight available to the algae, potentially contributing to the start of and growth of the bloom.



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## Why don't wastewater treatment plants around the SF Bay remove nutrients?

14 of the 37 wastewater treatment plants in the region have enhanced nutrient removal, and several more are in the process of implementing upgrades to further reduce nutrients. Enhanced nutrient removal is very costly and has not historically been required in the SF Bay, because the ecosystem had been considered resilient to harmful algae blooms. This resilience has been attributed to tidal mixing, low water clarity which limits algal growth, and a large population of organisms, such as clams, that feed on algae. With water clarity increasing due to upstream dams capturing sediment, and a decrease in clam populations, this resiliency may be decreasing, as shown by the 2022 algal bloom.

## What will it cost to reduce nutrient loads from wastewater treatment plants?

Upgrading all wastewater treatment plants to remove nutrients to the lowest levels feasible could cost the region over twelve billion dollars. Unless significant federal or state infrastructure grants become available to our region for nutrient removal, ratepayers would need to pay for these upgrades through increases in their wastewater bills.

## How are nutrients in wastewater regulated in the SF Bay Area?

Nutrients are regulated via a Watershed Permit, which is administered by the San Francisco Regional Water Quality Control Board. The current Watershed Permit requires wastewater treatment plants to:

1. Measure and report the amount of nutrients they discharge to the SF Bay;
2. Provide financial support to a Nutrient Management Strategy (NMS) Science Program to understand the impacts of nutrients on the SF Bay water quality; and
3. Investigate alternatives for reducing nutrients in wastewater discharge.

The next Watershed Permit, which will be adopted in 2024, is currently under development and will further address nutrient management in the SF Bay region.

## How can the investments that SF Bay Area wastewater agencies have made in the NMS Science Program help us understand the bloom, and plan our next steps?

Over the past decade, wastewater agencies have invested more than \$14 million dollars in science programs to study the impacts of nutrients in the SF Bay. The scientists involved with the NMS, a science program housed at the San Francisco Estuary Institute, have:

1. Developed a monitoring network to observe impacts that may be linked to nutrients;
2. Performed studies to better understand the biological and chemical processes affecting nutrients in the SF Bay; and
3. Built a numerical model to better understand and predict the impacts of nutrients on biological and chemical processes in the SF Bay.

As wastewater agencies move to implement projects that will reduce nutrients in the SF Bay, they will work closely with the NMS science program and use the tools and monitoring stations in place to understand how these changes will benefit water quality in the SF Bay.